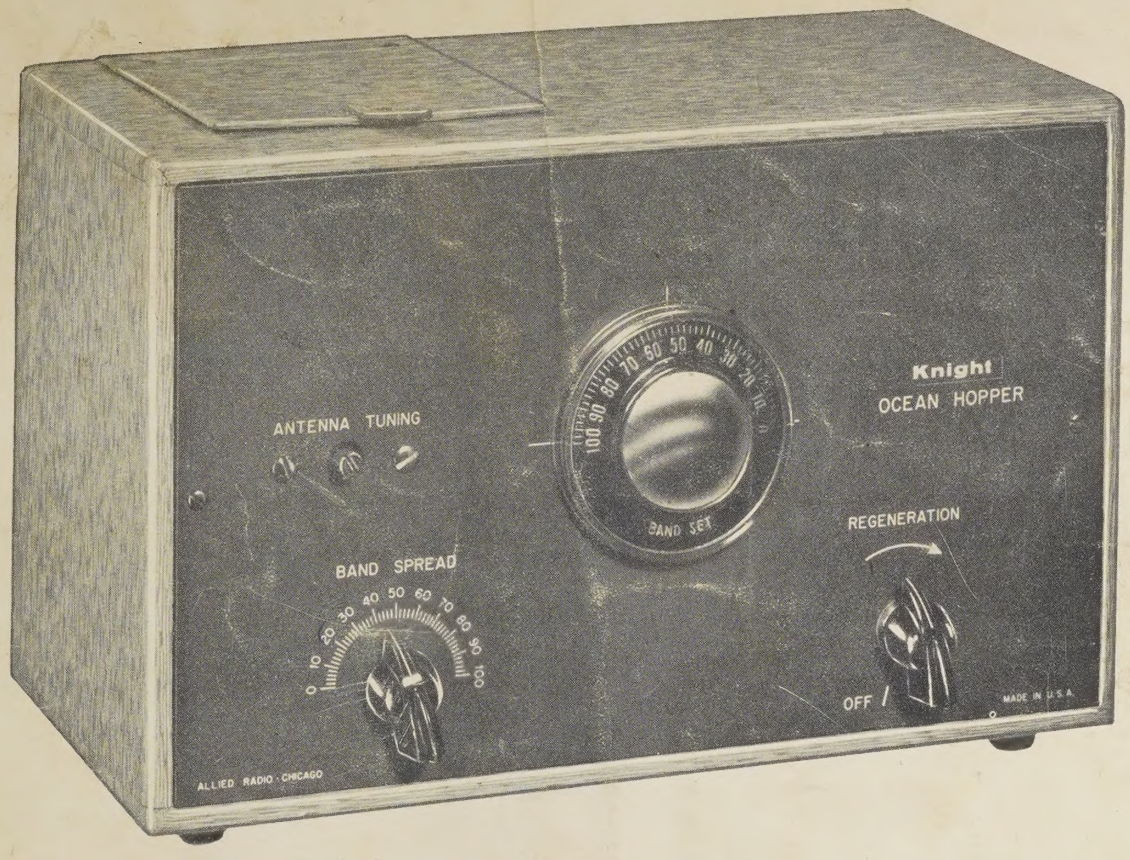
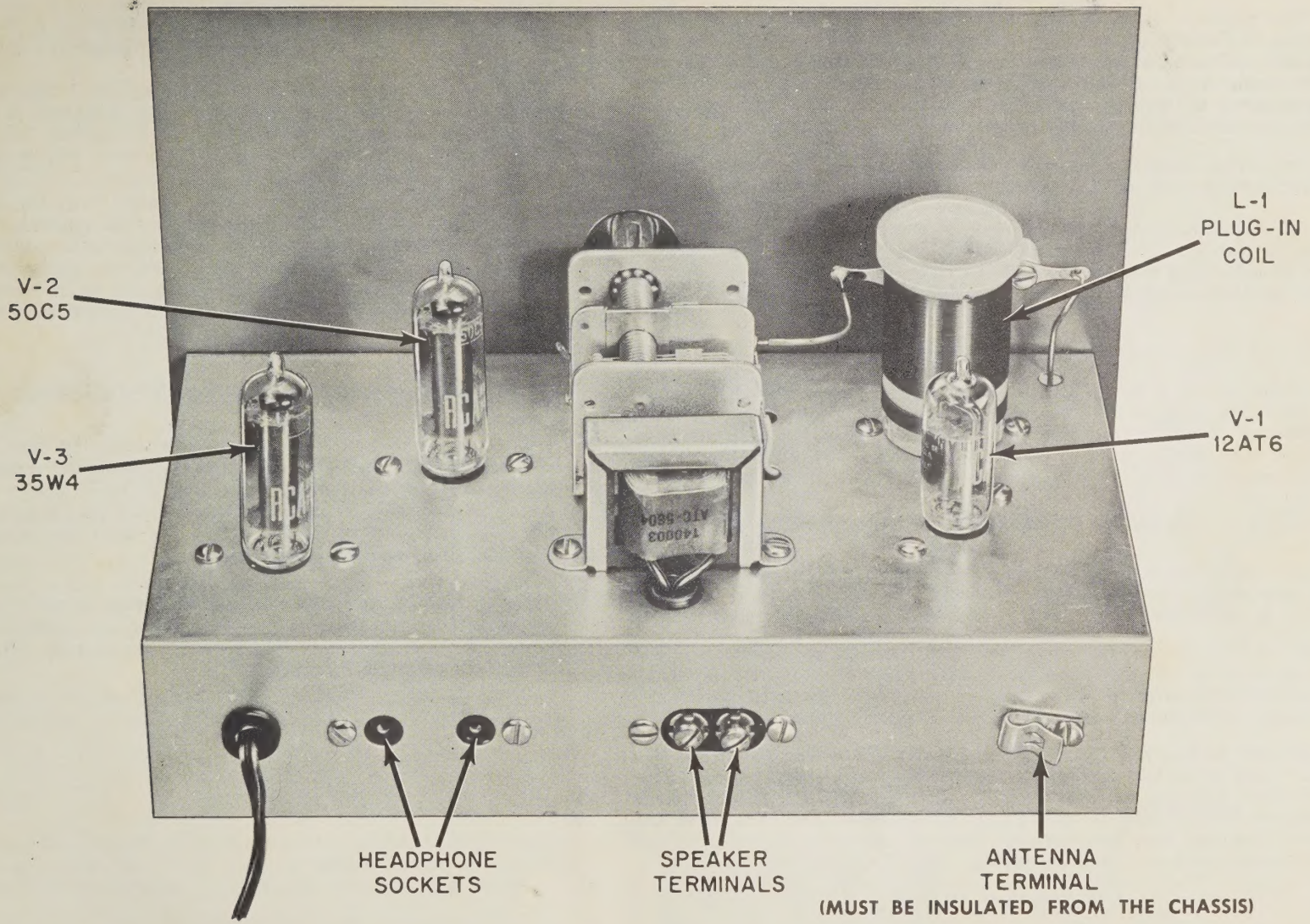


OCEAN HOPPER 83 Y 749

ASSEMBLY MANUAL

A PRODUCT OF ALLIED RADIO · CHICAGO

knight-kit®


V-2
50C5
V-3
35W4
L-1
PLUG-IN
COIL
V-1
12AT6
HEADPHONE
SOCKETS
SPEAKER
TERMINALS
ANTENNA
TERMINAL
(MUST BE INSULATED FROM THE CHASSIS)

INTRODUCTION

The highly efficient, easy-to-build Ocean Hopper clearly picks up stations from all over the world.

This receiver covers an extremely wide tuning range from 155 kilocycles to 35 megacycles. This includes the Long Wave Band, the AM Broadcast Band, and the Short Wave Bands. Six coils are used to cover this tuning range. Changing from one band to another is accomplished by plugging in the proper coil. The AM Broadcast Band coil is included with this kit. The five accessory coils are listed on page 15.

Due to its extremely sensitive regenerative circuit, the Ocean Hopper receives either code (CW) or modulated (voice and music) broadcasts.

An important feature of the Ocean Hopper, which greatly adds to its ease of operation, is a bandspread tuning dial. Since short wave stations are crowded very close together, the bandspread dial is extremely helpful. The bandspread will separate and precisely tune each station.

CHECKING YOUR KIT

Before starting to build your Ocean Hopper, check again each part against the parts list on page 15. This will help you become acquainted with each part. If you are unable to identify some of the parts by sight, locate them on the pictorial diagrams. In this manual the Greek letter "μ" means "micro", "Ω" means "ohm", and "K" equals thousand.

HOW TO BUILD THE OCEAN HOPPER

The only tools necessary for building the Ocean Hopper are: A pair of long-nose, side-cutting pliers, a small screwdriver, and a soldering iron. A pair of diagonal cutting pliers can help to simplify construction.

Study the pictorial diagrams, and note how the parts are mounted. These pictorial diagrams show the actual location of all parts and wiring. The schematic diagram shows how the parts are connected electrically and also helps you understand how the circuits function.

Be sure to follow the step-by-step instructions when assembling this kit — this is the best and fastest method of assembly. We suggest that you check off each step in the box ☐ after you have finished it. Some builders also put a pencil mark on the wiring views along the wires and parts that they have just installed. Both of these methods are good and will assure quick and accurate wiring.

WIRING HINTS

How well a piece of electronic equipment works depends on the quality of workmanship used in its construction. It is for this reason that the following suggestions are made. These suggestions are mainly for the beginner. However, even experienced persons may benefit from a brief review.

The insulated wire furnished with this kit is cut to length and the ends are stripped to save you time and trouble. Each different colored wire is a different length, therefore, be sure to use the color specified in each of the wiring steps.

A piece of bare wire is included. Whenever it is necessary to use some of it, the exact length of the piece required is given.

The soft tubing supplied is called "spaghetti." Spaghetti is used to cover the bare leads of some of the parts. Whenever it is necessary to use some of this spaghetti, the exact length is given. The spaghetti must cover the entire lead where there is a chance it will touch another lead, a connection, or the chassis.

Unless otherwise stated, all the leads on the resistors, capacitors, and transformer should be as short as possible. Figure 1 illustrates the best way to connect a component. As shown, the leads should be pulled through the terminals so that the parts are tightly mounted. After a lead is pulled through a terminal, bend it around the terminal and cut off the excess wire.

HOW TO CARE FOR YOUR SOLDERING IRON

Your soldering iron is the key to good soldering since it supplies the essential ingredient–HEAT. If the tip is covered by a dirt (oxide) film, the iron will not be able to transfer its full heat. A new tip can be protected from film by coating it with solder the first time it is heated. An old tip should first be cleaned with a file until bare copper is exposed. Then solder-coat it like a new tip.

Never use the iron like a brush—soldering is not a paste-spreading operation. To get the most heat out of the iron, always press the iron firmly to the connection. Hold it so the greatest tip surface is directly in contact with the connection.

THIS KIT MUST BE *PROPERLY* SOLDERED!

WITHOUT GOOD SOLDERING, AN ELECTRONIC UNIT WILL NOT WORK . . . just as a suit of clothing will fall apart if the stitches are loose . . . no matter how excellent the material.

USE ENOUGH HEAT

This is the main idea of good soldering. The purpose of soldering is to join metal parts, making an UNBROKEN metal path over which electricity can travel. To do this you must apply enough heat to the metal surfaces to make the solder spread freely on them, until the contour (shape) of the connection shows under the solder. If the solder barely melts and forms a rounded ball, *you are not using enough heat.* If you do not use enough heat, there may be no electrical connection, although it appears soldered.

HERE'S HOW TO DO IT . . .

1. Join bare metal to bare metal. Insulation must be removed.

2. Coat the tip of a hot iron with solder.

3. FIRMLY PRESS THE FLAT SIDE OF THE TIP OF A HOT IRON FLAT against the parts to be soldered together. Keep it there while you apply the solder BETWEEN THE IRON TIP AND THE METAL TO BE SOLDERED. Use only enough solder for it to flow over ALL the surfaces of the connection. Remove the iron.

4. DO NOT MOVE PARTS UNTIL THE SOLDER HARDENS. If you accidentally move the wires as the solder is hardening, apply your iron and reheat.

Compare your soldering with the pictures on this page. You have a good connection if your solder has flowed over all surfaces to be connected, following the shape of the surfaces. It should appear smooth and bright.

YOU HAVE NOT USED ENOUGH HEAT: If your connection is rough and flaky-looking, or if the solder has formed a round ball instead of spreading.

The difference between good soldering (enough heat) and poor soldering (not enough heat,) is just a few extra seconds with a hot iron FIRMLY applied. Remember, larger metal surfaces take a longer time to heat.

USE A 100-WATT IRON

A 100-watt soldering iron with a clean, chisel-shaped tip will supply the right amount of heat when used correctly. Notice how the iron is held in the picture. Heat the iron for 10 minutes before you start soldering. Keep the tip brightly coated with solder. When necessary, wipe the hot tip clean with a cloth. (If you use a soldering gun, be sure the tip reaches full heat before you solder.)

USE ONLY ROSIN CORE SOLDER

We supply the right kind of solder *(rosin core solder).* Do not use any other kind of solder! USE OF ACID CORE SOLDER, PASTE, OR IRONS CLEANED ON A SAL AMMONIAC BLOCK WILL RUIN ANY ELECTRONIC UNIT AND WILL VOID THE GUARANTEE.

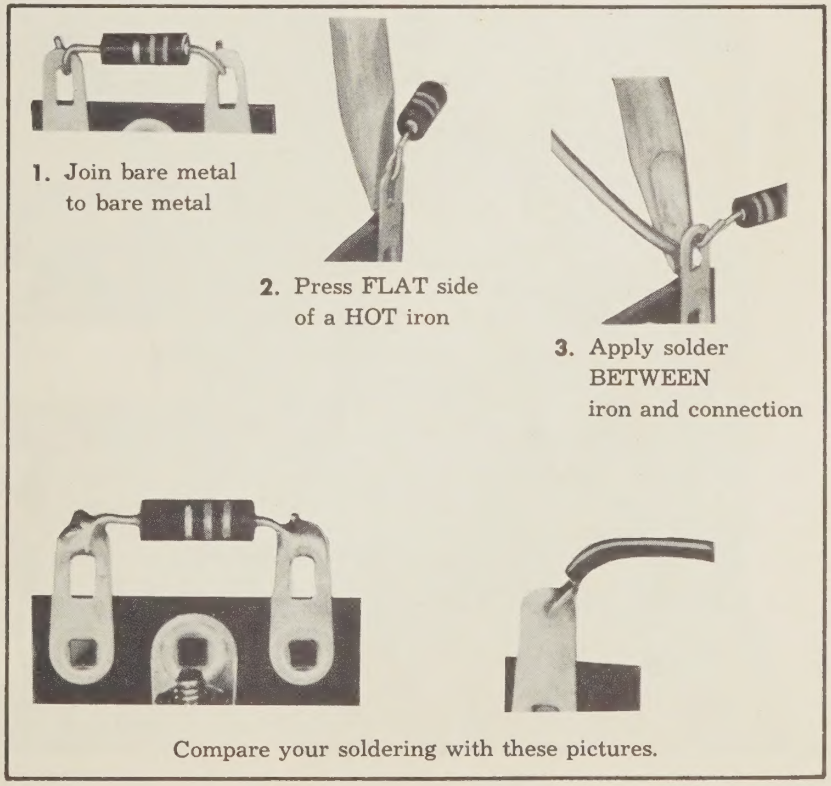


FIGURE 1. THE ONE-TWO-THREE OF GOOD SOLDERING.

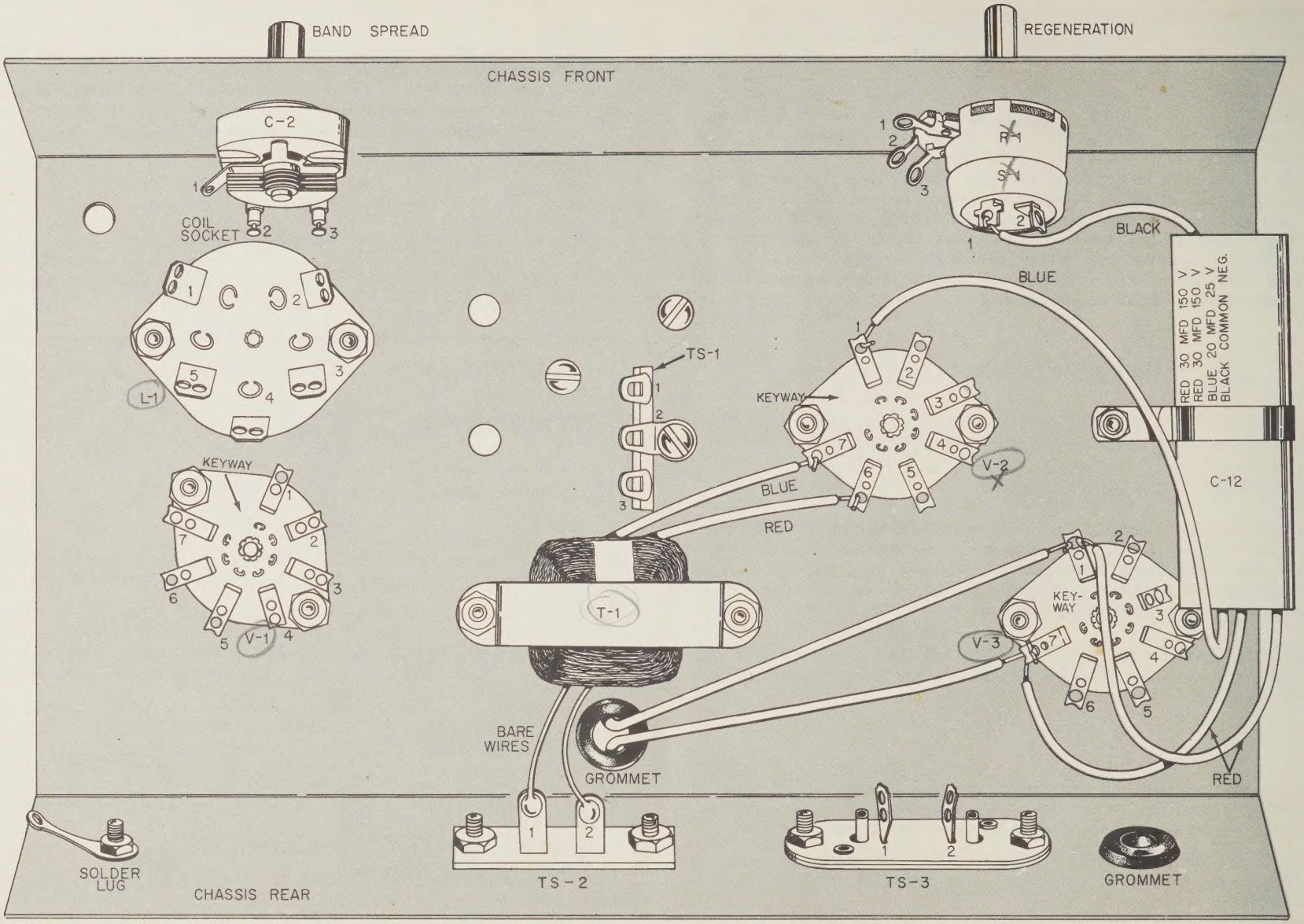


FIGURE 2. PARTS MOUNTING AND FIRST WIRING

CONSTRUCTION

SEE FIGURE 2.

☒ Place the chassis in the position shown.

☒ Insert the two rubber grommets in the holes shown. Grommets are inserted by squeezing them into the holes.

Screws of two different lengths are supplied with the kit. One length is ¼", the second length is $\frac{5}{16}$". Separate the screws according to length and use only the $\frac{5}{16}$" screws unless the instructions specify ¼".

☒ Mount the three tube sockets V-1, V-2, and V-3, positioning the keyway or wide open space between two terminals as shown. Use two screws and matching nuts to fasten each socket.

☒ Mount the coil socket, L-1, with two screws and matching nuts. Be sure to position the 5-terminals as shown in Figure 2.

☒ Mount terminal strip, TS-2, in the position shown using two screws and matching nuts.

☒ Mount terminal strip, TS-3, in the position shown using two screws and matching nuts.

The output transformer, T-1, has four leads, one red, one blue, and two bare. The filter choke, L-2, is similar in appearance to T-1 except that it has only two black leads.

T-1 and L-2 are mounted with the same two screws and matching nuts. T-1 is mounted as shown in Figure 2 and L-2 is mounted on the opposite side of the chassis with the two black leads next to the grommet. (See Figure 7 on Page 10).

☒ Mount T-1 and L-2.

☒ Push the two black leads from L-2 through the grommet to the bottom of the chassis as shown.

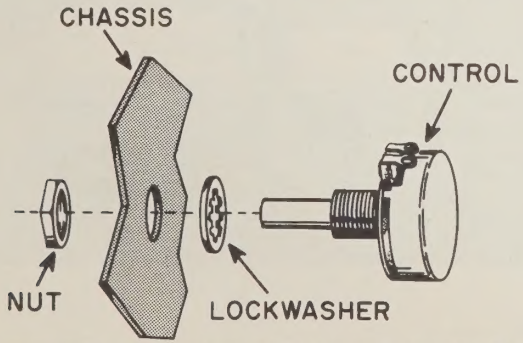


FIGURE 3. HOW TO INSTALL THE CONTROL

☒ Mount C-12, the electrolytic capacitor with four wires, one black, one blue, and two red. Use a screw and a matching nut to fasten C-12.

☒ Mount R-1, the combination REGENERATION control and S-1 OFF switch, as shown. Use a lockwasher and the large nut to fasten R-1 as shown in Figure 3.

☒ Mount C-2, the BAND SPREAD capacitor, as shown. Use the medium-size nut to fasten C-2.

☒ Mount the Fahnestock clip and solder lug in the position shown in the corner of the chassis. Use the screw, **fiber washers,** and nut to fasten the clip and lug as shown in Figure 4 **so the clip is insulated from the chassis.**

☒ Mount C-3, the BAND SET capacitor, on top of the chassis. C-3 is fastened by three screws through the bottom of the chassis. The terminal strip, TS-1, is mounted by one of the C-3 fastening screws as shown.

☒ Solder one of the T-1 bare leads to terminal 1 of TS-2. Solder the other bare lead to terminal 2.

☒ Connect, but do not solder, the T-1 red lead to pin 6 of V-2. Connect, but do not solder, the blue lead to pin 7.

☒ Connect, but do not solder, either of the L-2 leads coming through the grommet to pin 7 of V-3. Connect, but do not solder, the other lead to pin 1.

☒ Connect, but do not solder, the C-12 black lead to terminal 1 on S-1.

☒ Connect, but do not solder, the blue lead from C-12 to pin 1 of V-2.

☒ Connect, but do not solder, either of the C-12 red leads to pin 1 of V-3. Connect, but do not solder the other C-12 red lead to pin 7.

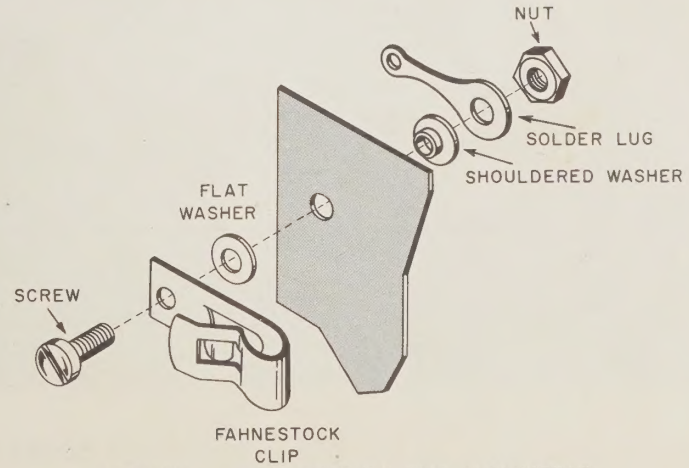


FIGURE 4. FAHNESTOCK CLIP MOUNTING

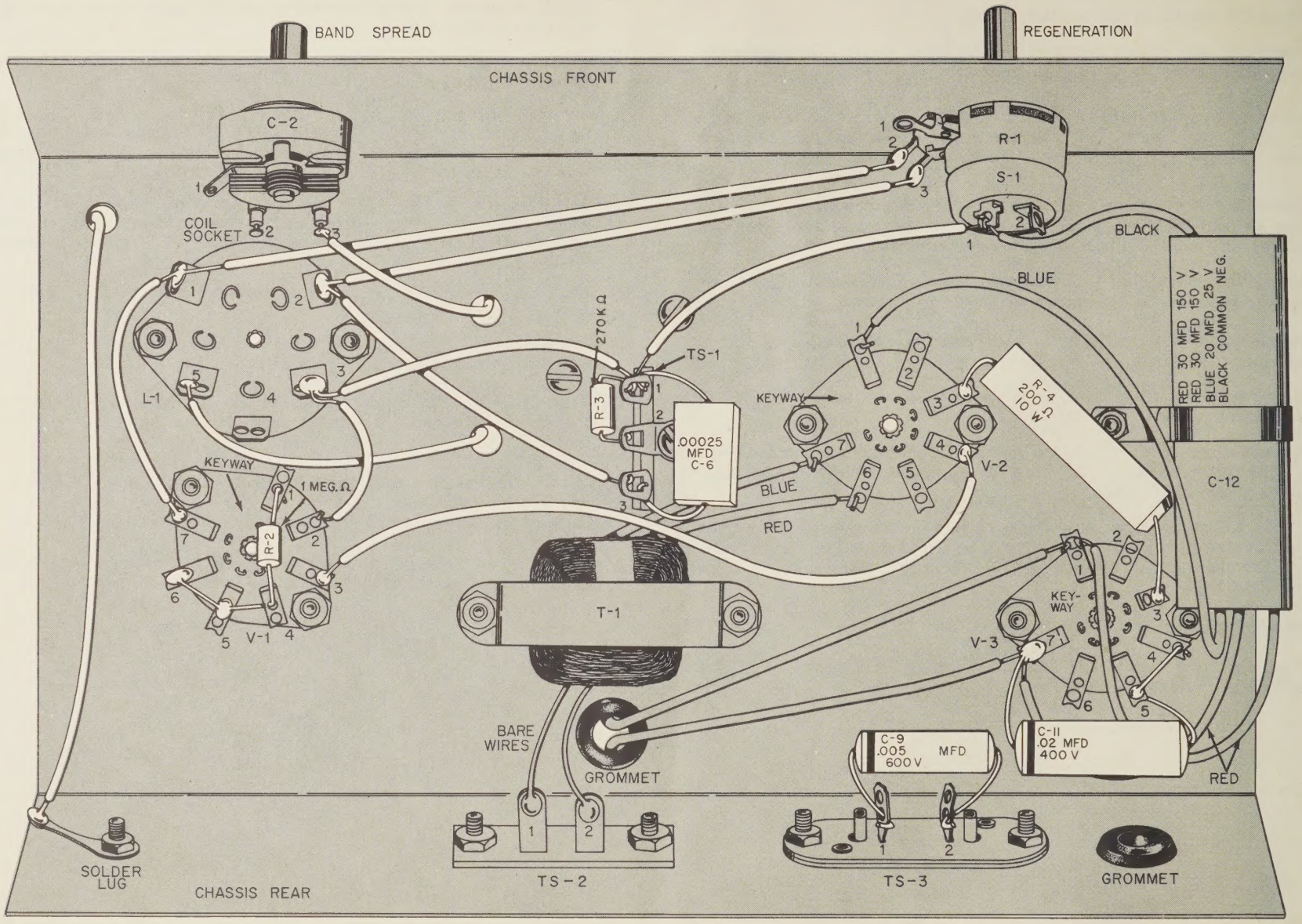


FIGURE 5. SECOND WIRING VIEW

SEE FIGURE 5.

- [ ] Solder an orange wire to pin 7 of V-1. Connect, but do not solder, the other end of this wire to terminal 1 of L-1, the coil socket.
- [ ] Solder one end of a violet wire to terminal 1 of L-1. Solder the other end of this wire to terminal 2 of R-1.
- [ ] Solder one end of a blue wire to terminal 3 of R-1. Connect, but do not solder, the other end of this wire to terminal 2 of L-1.
- [ ] Solder one end of a yellow wire to terminal 2 of L-1. Connect, but do not solder, the other end of this wire to terminal 3 of TS-1.
- [ ] Solder one lead of R-4, a large 200Ω, 10 watt resistor, to pin 3 of V-2. Solder the other lead to pin 3 of V-3.
- [ ] Solder the lead from the banded end of C-11, a .02 μfd tubular capacitor, to pin 7 of V-3. Push the other lead of C-11 through pin 5 of V-3, and, connect, but do not solder, it to pin 4 of V-3. Solder pin 5.
- [ ] Connect, but do not solder, the lead from the banded end of C-9, a .005 μfd tubular capacitor, to terminal 1 of TS-3. Connect, but do not solder, the other lead of C-9 to terminal 2 of TS-3.
- [ ] Solder one end of a yellow wire to terminal 5 of L-1. Push the other end of this wire through the hole in the chassis as shown.
- [ ] Connect, but do not solder, one end of a red wire to pin 2 of V-1. Connect, but do not solder, the other end to terminal 3 of L-1.
- [ ] Solder one end of an orange wire to terminal 3 of L-1. Connect, but do not solder, the other end of this wire to terminal 1 of TS-1.
- [ ] Solder an orange wire to terminal 3 of C-2. Push the other end of this wire through the hole in the chassis as shown.
- [ ] Connect, but do not solder, one lead of R-3, a 270KΩ resistor (with the color stripes red, violet, yellow), to terminal 1 of TS-1. Connect, but do not solder, the other lead of R-3 to terminal 2 of TS-1.
- [ ] Connect, but do not solder, one lead of C-6, a .00025 μfd mica capacitor (may be marked 250), to terminal 1 of TS-1. Connect, but do not solder, the other lead of C-6 to terminal 3 of TS-1.
- [ ] Connect, but do not solder, one end of a yellow wire to terminal 1 of TS-1. Connect, but do not solder, the other end of this wire to terminal 1 of S-1.
- [ ] Solder one end of a blue wire to pin 3 of V-1. Solder the other end of this wire to pin 4 of V-2.
- [ ] Connect, but do not solder, one lead of R-2, a 1 megΩ resistor (brown, black, green) to pin 1 of V-1. Push the other lead through pins 4, 5, and 6 of V-1. Solder pins 5 and 6, but do not solder pin 4.
- [ ] Solder one end of a violet wire to the solder lug at the rear of the chassis. Push the other end through the hole in the chassis as shown.

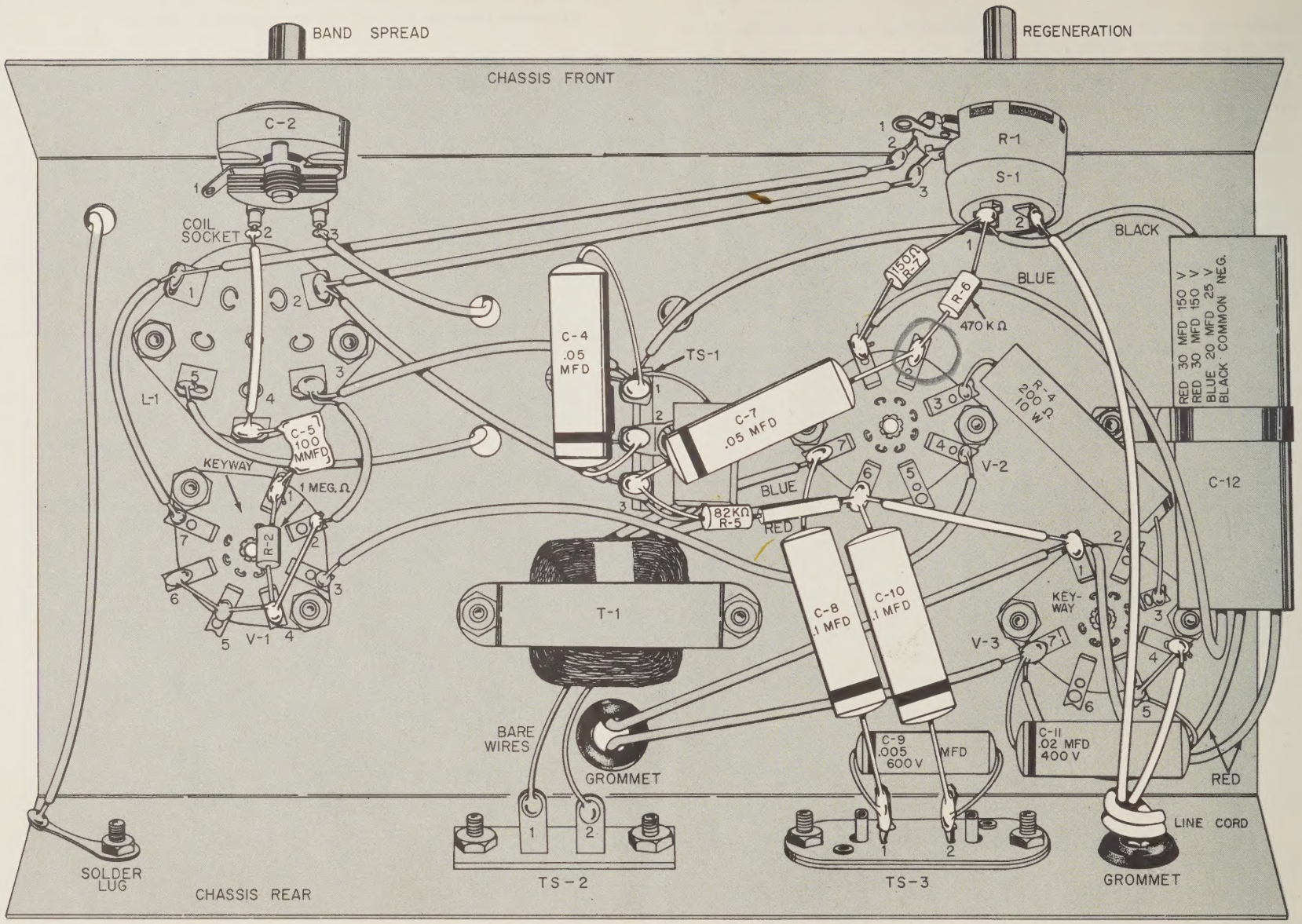


FIGURE 6. THIRD WIRING VIEW

SEE FIGURE 6.

☒ Solder one end of a red wire to terminal 2 of C-2. Connect, but do not solder, the other end of this wire to terminal 4 of of L-1.

☒ Solder one lead of C-5, a 100 $\mu\mu$fd capacitor (may be marked .0001), to pin 1 of V-1. Solder the other lead of C-5 to terminal 4 of L-1.

☒ Pass a 1″ bare wire through pins 2 and 4 of V-1 and solder both pins.

☒ Solder the lead from the striped end of C-4, a .05 μfd tubular capacitor, to terminal 2 of TS-1. Solder the other lead of C-4 to terminal 1 of TS-1.

☒ Solder the lead from the striped end of C-8, a .1 μfd tubular capacitor, to terminal 1 of TS-3. Solder the other lead of C-8 to pin 7 of V-2.

☒ Solder the lead from the striped end of C-10, a .1 μfd tubular capacitor, to terminal 2 of TS-3. Connect, but do not solder, the other lead of C-10 to pin 6 of V-2.

☒ Solder one end of an orange wire to pin 1 of V-3. Connect, but do not solder, the other end of this wire to pin 6 of V-2.

☒ Cut ½″ from the spaghetti, (the soft insulating tubing) and slip it over one lead from R-5, an 82KΩ resistor (gray, red, orange).

☒ Solder the lead of R-5 with the spaghetti to pin 6 of V-2. Connect, but do not solder, the other lead of R-5 to terminal 3 of TS-1.

☒ Solder the lead from the striped end of C-7, a .05 μfd tubular capacitor, to terminal 3 of TS-1. Connect, but do not solder, the other lead of C-7 to pin 2 of V-2.

☒ Solder one lead of R-6, a 470KΩ resistor (yellow, violet, yellow) to pin 2 of V-2. Connect, but do not solder, the other lead of R-6 to terminal 1 of S-1.

☒ Solder one lead of R-7, a 150Ω resistor (brown, green, brown) to terminal 1 of S-1. Solder the other lead of R-7 to pin 1 of V-2.

CAUTION: DO NOT TOUCH ANY OF THE WIRING WHILE THIS UNIT IS PLUGGED INTO A POWER OUTLET. NEVER USE OR TEST THE OCEAN HOPPER ON OR NEAR A GROUNDED METAL BENCH, RADIATOR, SINK, OR OTHER GROUNDED METAL OBJECT.

☒ Push the bare end leads of the line cord through the grommet from outside the chassis and tie a knot in the cord inside the chassis about 4½″ from the bare ends. Solder one line cord lead to terminal 2 of S-1, and solder the other lead to pin 4 of V-3.

☒ Turn the chassis over.

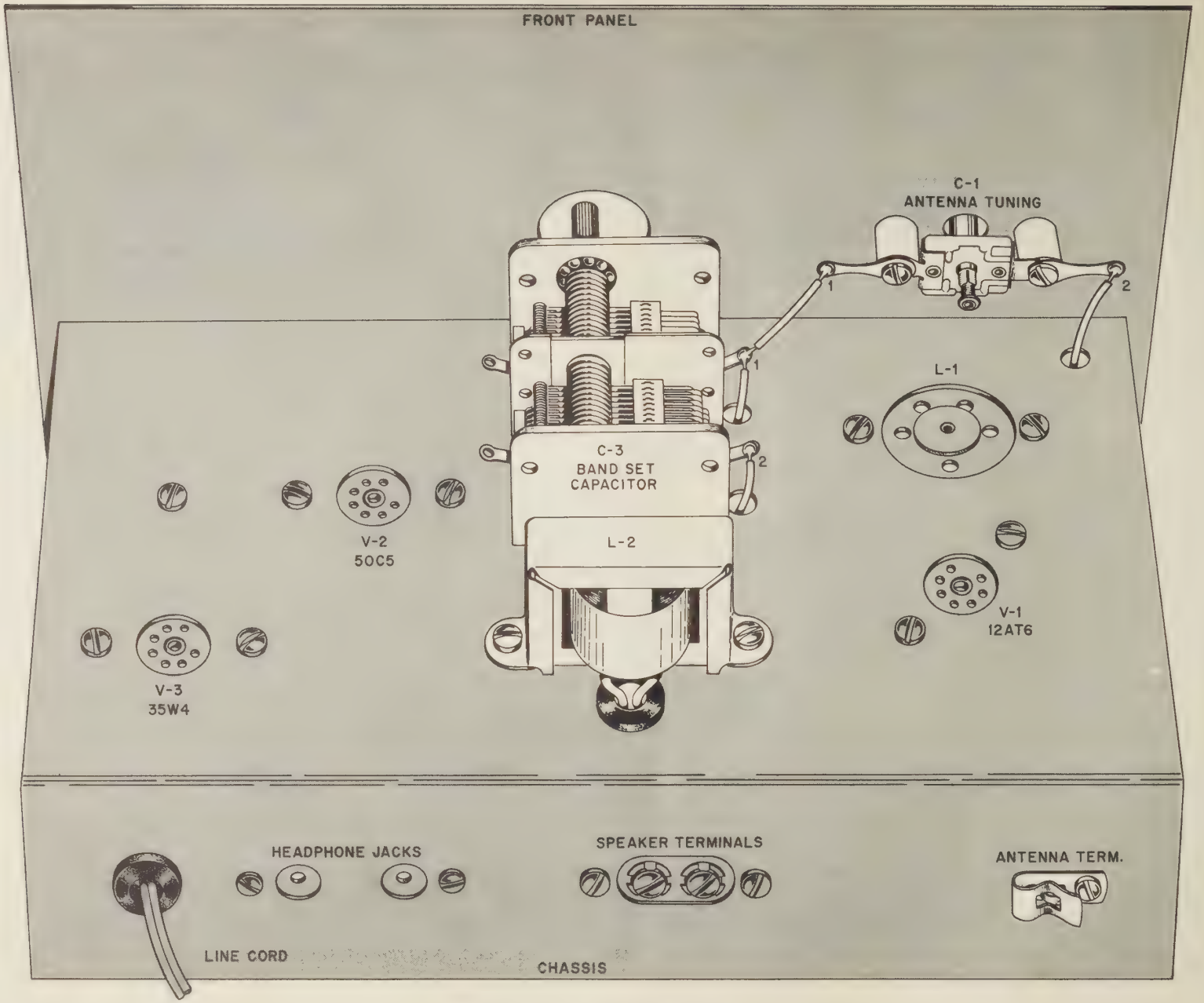


FIGURE 7. TOP WIRING VIEW

TOP WIRING

SEE FIGURE 7.

☐ Remove the nuts holding R-1 and C-2.

☐ Match the front panel holes with "BAND SPREAD" and "REGENERATION" printed above them with the shafts of R-1 and C-2. Fasten the front panel to the chassis with the two nuts removed from R-1 and C-2.

☐ Mount C-1, the ANTENNA TUNING capacitor, as shown in Figure 8. Use the ¼" screws, the two solder lugs and the ceramic spacers to fasten C-1. **Be sure to use only the ¼" screws otherwise the capacitor will short.**

☐ Solder the yellow wire coming through the chassis hole to terminal 2 of C-3.

☐ Connect, but do not solder, the orange wire coming through the chassis to terminal 1 of C-3.

☐ Solder one end of a red wire to terminal 1 of C-1. Solder the other end of this wire to terminal 1 of C-3.

☐ Solder the violet wire coming through the chassis to terminal 2 of C-1.

☐ Turn the shaft of the BAND SET capacitor, C-3, until the plates of the capacitor are closed (completely meshed). While C-3 is in this position, press the large BAND SET knob onto the shaft so that the number "0" is lined up with the vertical line printed on the front panel.

☐ Turn the shaft of the BANDSPREAD capacitor, C-2, until the plates of the capacitor are closed (completely meshed). While C-2 is in this position, place one of the black knobs on the shaft so that the pointer is lined up with the number "0" printed on the front panel. Tighten the setscrew to hold the knob in place.

R-1, the REGENERATION control, has the OFF switch built into it.

☐ Turn the shaft of the REGENERATION control counterclockwise until the switch "clicks" off.

☐ Put the second black knob on the shaft of the REGENERATION control so that the pointer is on the line printed on the panel next to the word "OFF." Tighten the setscrew.

☐ Refer to the photograph on Page 1. Plug the three tubes into the correct sockets as shown. Note that there is a wide space between two of the tube pins which will match a corresponding wide space in the tube socket pin holes.

☐ Plug the coil, L-1, into its socket.

☐ Mount the completed unit in the cabinet.

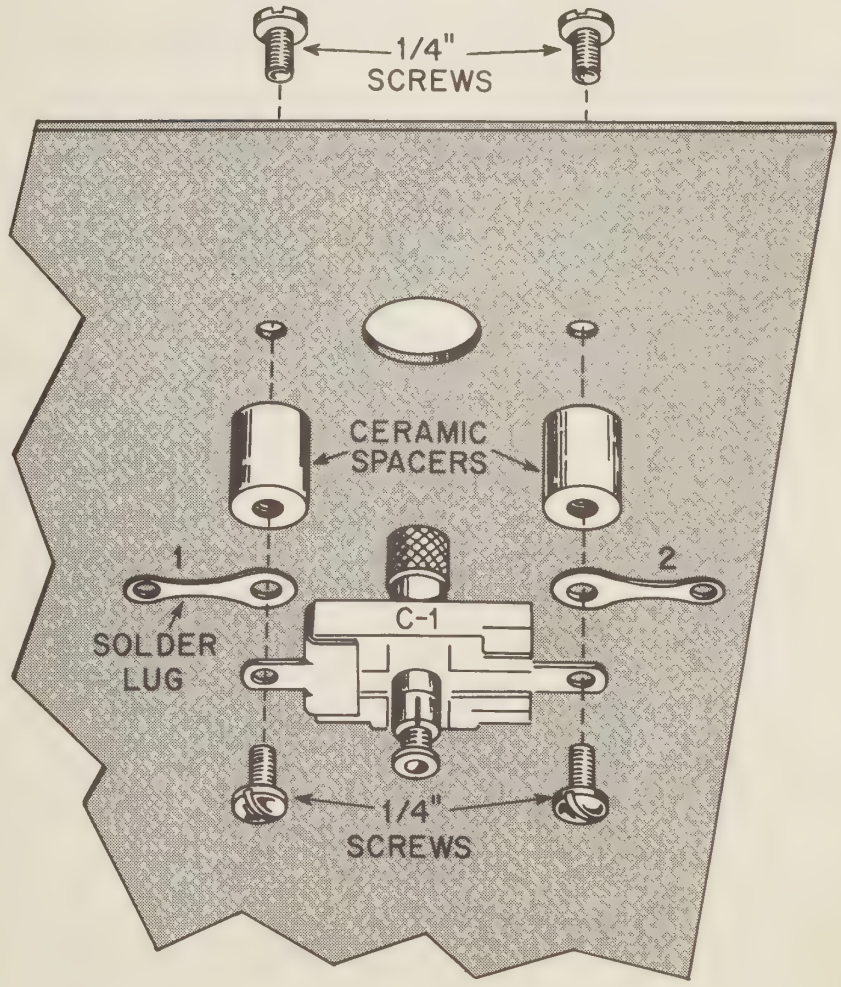


FIGURE 8. C-1 MOUNTING DETAIL

RADIO ANTENNAS

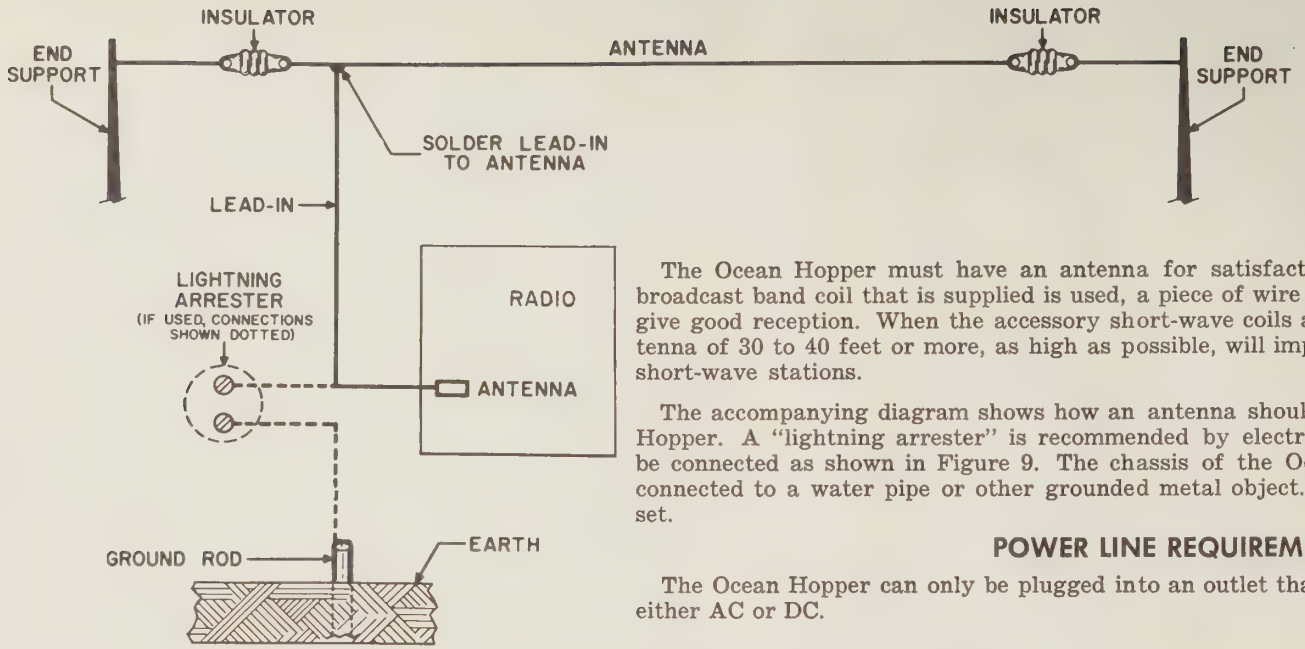


FIGURE 9. HOW TO INSTALL AN ANTENNA

The Ocean Hopper must have an antenna for satisfactory performance. When the broadcast band coil that is supplied is used, a piece of wire 10 feet or more will probably give good reception. When the accessory short-wave coils are used, a longer outdoor antenna of 30 to 40 feet or more, as high as possible, will improve reception of the weaker short-wave stations.

The accompanying diagram shows how an antenna should be connected to the Ocean Hopper. A "lightning arrester" is recommended by electrical and fire codes and may be connected as shown in Figure 9. The chassis of the Ocean Hopper should NOT be connected to a water pipe or other grounded metal object. The ground is built into the set.

POWER LINE REQUIREMENTS

The Ocean Hopper can only be plugged into an outlet that will supply 105 to 125 volts either AC or DC.

OPERATING YOUR OCEAN HOPPER

Your Ocean Hopper, while not difficult to operate, requires some practice before peak performance, particularly on short wave, can be realized. This receiver covers the Long Wave Band from 155 to 470 kilocycles; the Broadcast Band from 530 to 1900 kilocycles; and four Short Wave Bands covering 1.65 to 4.1 megacycles, 2.9 to 7.3 megacycles, 7 to 17.5 megacycles, and 15.5 to 35 megacycles. The Broadcast Band coil is supplied with this kit. Five additional coils may be purchased as accessories (see page 15). We suggest that you learn to operate this receiver on the Broadcast Band before attempting to receive short wave signals.

☐ Connect a suitable antenna to the clip on the rear of the chassis.

☐ Connect either a speaker or a headphone set to the appropriate terminals at the rear of the chassis. Do not connect both a speaker and a headphone at the same time.

☐ Plug the line cord into a suitable outlet.

CAUTION: NEVER TOUCH ANY PART OF THE WIRING WHILE THIS RECEIVER IS PLUGGED INTO A POWER OUTLET. NEVER USE OR TEST THE OCEAN HOPPER ON OR NEAR A GROUNDED METAL BENCH, RADIATOR, SINK OR OTHER GROUNDED METAL OBJECT. SERIOUS BODILY INJURY OR PROPERTY DAMAGE MAY RESULT IF THIS WARNING IS NOT HEEDED.

☐ Turn the REGENERATION control so that the switch "clicks" on and continue turning the knob as far as it will go in the direction of the arrow.

☐ Turn the ANTENNA TUNING knob clockwise until it is tight and then loosen it one turn.

Let the tubes have a minute to warm up.

The regenerative detector in your Ocean Hopper is capable of extremely high **selectivity** (selectivity is the ability of a radio to receive only one station and reject all others).

BROADCAST BAND TUNING PROCEDURE

☐ Set the BANDSPREAD control at 50.

☐ After the receiver is warmed up, rotate the BAND SET control through its range. You should hear loud whistles. PLEASE NOTE: If the power being used by you is direct current (C), you may not hear these whistles. Should this happen, pull the plug out of the power outlet, reverse it, and plug it back in. If you rotate the BAND SET control very slowly, the whistle will start at a high pitch, fall to an increasingly low pitch, pass through zero (no sound at all) and then rise toward a high pitch as you tune past a particular signal.

☐ Set the BAND SET control to one of the whistles, so that the whistle is at a low pitch. The pitch may be difficult to control with the BAND SET knob. If so, lower the pitch by rotating the BAND-SPREAD control to the right or left.

☐ Reduce the setting of the REGENERATION control to the point where the whistle just disappears. Slowly turn the ANTENNA TUNING control until the whistle reappears.

☐ Turn the REGENERATION control slowly in the direction opposite to the arrow printed on the front panel. At the proper point the whistle will stop and you will be able to hear the program.

The Ocean Hopper is now adjusted for the best voice and music reception. If the program sounds "mushy", reduce the setting of the REGENERATION control **slightly.**

If you hear more than one station at a time, the ANTENNA TUNING control is advanced too far. If reception is too faint, the ANTENNA TUNING control is not advanced far enough. The setting of this control should vary from station to station across the band. It should be readjusted for best reception as required.

SHORT WAVE BAND TUNING PROCEDURE

☐ Replace the Broadcast Band coil with a Short-wave Band coil of your choosing. Adjust all the knobs in exactly the same way as you did for regular broadcast stations. You will notice that the short wave stations are a little harder to "tune in". Just a bit of turning on any of the knobs may make a lot of difference. With a little practice you will soon be able to tune in the short wave stations easily.

There are two types of radio signals used for short-wave broadcasting: Code (CW), and voice and music (modulated). The modulated signals are tuned in exactly the same way as Broadcast Band signals. The CW signals are tuned in by setting the REGENERATION control until you hear a whistle. Use the BAND SET knob and BANDSPREAD knob just as you used them to tune in a regular station. When you have it tuned right, you will hear the code as a series of dots and dashes — rather like breaks (short and long). If you think the whistled dots and dashes are too high pitched, turn the REGENERATION knob down until it sounds better, but not so much that the whistle stops entirely.

At the high end of the Short-wave Band, do not advance the REGENERATION control too far. Otherwise, a loud hiss will be heard. When this happens, the selectivity and sensitivity of the receiver will be greatly reduced.

The ANTENNA TUNING control is sensitive to the touch. The strength of the received station will vary if you put your hand close to or touch the ANTENNA TUNING control.

NOTE: When using the Long Wave Band coil, do not tighten the ANTENNA TUNING control so far that the screw touches the windings on the coil.

SERVICE HINTS

If you have followed all the previous instructions carefully, your receiver should perform well. If it does not, however, here are several hints you can follow:

If excessive hum is encountered, reverse the position of the line cord plug in the socket. In one position there may be less hum than in the other.

If the set still hums, check the connections of the filter capacitor, C-12, against the pictorial diagram.

If the tubes do not light up, check the wiring of the filament connections. If the wiring of the filament connections is OK, one of the tubes may have an open filament. Most radio and TV shops will test the tubes for you without charge.

If the tubes do light up, and the set is dead, turn the set off and pull the line cord plug out of the socket. Check all the solder connections and check the wiring again. Have someone else with radio experience check your wiring, if possible.

A schematic circuit diagram of this set is located on page 15.

THE IONOSPHERE AND RADIO RECEPTION

You may wonder why at some times you can hear a particular station, while at other times it is impossible to hear it. This condition can best be explained by referring to Figure 10.

In Figure 10, the tower at "A" is the transmitting antenna, while the towers labeled "B" and "C" are receiving antennas. As shown, radio waves go out in all directions from the transmitting antenna. These waves are labeled "a", "b", and "e".

Let's take wave "a" first. This is known as the ground wave because it hugs the ground, and is rapidly absorbed by it. The ground wave is present in the same location at all times when the transmitter is operating. Any receiver within the area of the ground wave, such as that at "B", will always receive the transmitted signal. This is why you always receive the programs broadcast by your local radio sations. The ground wave completely disappears after it has traveled a certain distance. A receiver located outside the range of the ground wave, such as that at "C", is not affected by it.

At the same time that the ground wave is being transmitted, other waves, called sky waves, are also being sent out. Referring to sky wave "b", notice that it is transmitted upward, but not straight up. This wave continues on up until it reaches a layer of particles up in the sky called the ionosphere. Here the wave does a peculiar thing. It bounces off the ionosphere back toward the Earth. If it bounces just right, receiver "B" will pick it up. Going a bit further, when this wave hits the Earth, it may bounce right back up toward the ionosphere. When it reaches the ionosphere, it bounces back toward the Earth.

Receiver "C" now picks up the transmitted signal because the sky wave has bounced right on to its antenna. It seems, then, that receiver "C" should always be able to "hear" transmitter "A". This would be true if the ionosphere stayed in one place, as indicated by the solid curved lines above the Earth. However, at different times of the day, and at different seasons of the year, the ionosphere shifts up and down. Suppose that the ionosphere shifts up, as indicated by the broken curved lines. Now the sky wave "b" must go higher before it bounces back toward the Earth (broken wave "d"). Consequently, it hits the Earth farther away from the transmitter and misses receiver "B" entirely. However, the ground wave still reaches "B", and it still hears the transmitter. When wave "d" bounces back up toward the ionosphere, it also misses receiver "C". Because the ground wave does not reach "C", he cannot hear the program being transmitted. This explains why you sometimes can, and sometimes cannot, hear a particular station.

Wave "e" shows what happens when a radio wave leaves the antenna straight up. It goes right through the ionosphere and never again reaches the Earth.

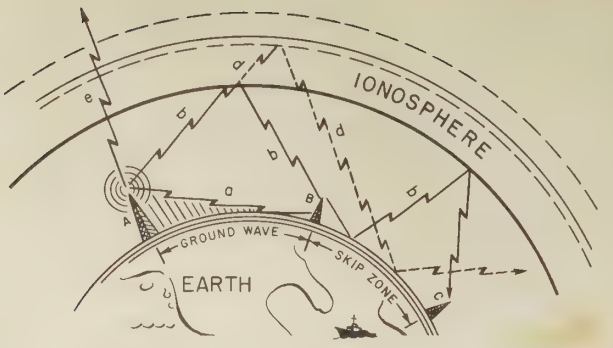


FIGURE 10. EFFECT OF THE IONOSPHERE ON RADIO WAVES

ALLIED'S SERVICE FACILITIES AND GUARANTEE

If this kit does not operate properly, we recommend the following:

Please write our Kit Department giving stock number and date of purchase of the kit. Also, describe fully what appears to be wrong. We may be able to determine a wiring error or a defective part.

This wired KNIGHT-KIT may be returned for inspection within one year after purchase for a special service charge of $2.50. Parts within the standard EIA 90-day warranty period will be replaced without charge for the parts. A charge will be made for parts damaged in construction or because of a wiring error, or for parts which are beyond the 90-day warranty period. After the one-year period, service charges are based on the length of time required to repair the unit, plus the cost of any parts required.

PLEASE NOTE: KITS WIRED WITH ACID CORE SOLDER OR PASTE FLUXES ARE NOT ELIGIBLE FOR REPAIR OR SERVICE AND WILL BE RETURNED TO YOU NOT REPAIRED, AT YOUR EXPENSE.

Allied's service facilities are primarily for inspection and trouble shooting. Kits not completely wired, which require extensive work, will be returned collect with a letter of explanation.

If you return this kit, pack it well. To prevent damage in shipment use a large enough carton so that cushioning material can be placed around the radio. Cushion it well and tightly. Mark it FRAGILE—DELICATE ELECTRONIC EQUIPMENT. Send the kit prepaid and insured. We will return the repaired kit to you C.O.D. as soon as repairs are completed. If you wish to save C.O.D. fees, your advance remittance may be enclosed for standard repair charges plus transportation costs. Any excess remittance will be refunded.

The designs and components selected for KNIGHT-KITS represent over a quarter of a century of experience in kit development. Allied extends these firm guarantees on KNIGHT-KITS:

All KNIGHT-KITS are sold with an exclusive money-back guarantee to meet or exceed published specifications and to perform exactly as specified or we refund your money.

We guarantee that only high-quality components are supplied. All parts are covered by the standard EIA 90-day warranty. Any faulty components will be replaced prepaid and without charge if reported to us within the warranty period. We reserve the right to request the return of defective parts.

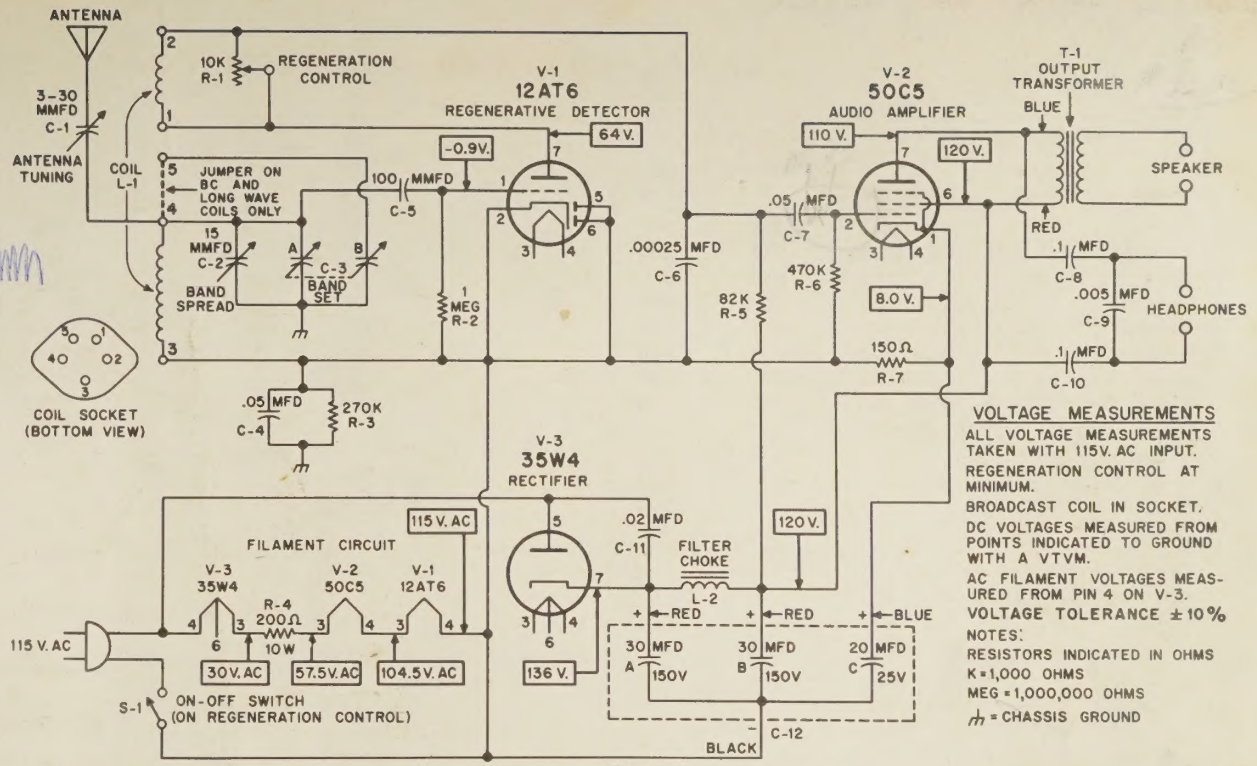
If your kit was damaged in a parcel post shipment, please write us at once, describing the condition in which the shipment was received. If your kit was part of a Railway Express shipment that was damaged in transit, please notify the Railway Express agent at once and then write us.

RESISTANCE CHART

All readings taken from point indicated to chassis ground except * readings taken from point indicated to B+. Control positions not significant. Power plug removed from power source. Variation in readings of ±20% will not affect operation. All measurements made with VTVM.

TUBE	PIN 1	2	3	4	5	6	7
V-1 12AT6	1.3Meg	270K	270K	270K	270K	270K	82K*
V-2 50C5	270K	740K	270K	270K	740K	O	200*
V-3 35W4	O*	NC	270K	270K	270K	270K	340*

NC — not connected



VOLTAGE MEASUREMENTS

ALL VOLTAGE MEASUREMENTS TAKEN WITH 115V. AC INPUT.

REGENERATION CONTROL AT MINIMUM.

BROADCAST COIL IN SOCKET.

DC VOLTAGES MEASURED FROM POINTS INDICATED TO GROUND WITH A VTVM.

AC FILAMENT VOLTAGES MEASURED FROM PIN 4 ON V-3.

VOLTAGE TOLERANCE ±10%

NOTES:

RESISTORS INDICATED IN OHMS

K = 1,000 OHMS

MEG = 1,000,000 OHMS

⏚ = CHASSIS GROUND

FIGURE 11. SCHEMATIC DIAGRAM

PARTS LIST

CAPACITORS

Symbol No.	Description	Part No.
C-1	ANTENNA TUNING 5-80 μμfd	283000
C-2	BAND SPREAD 15μμfd	281000
C-3	BAND SET	282004
C-4	Paper .05-400V	245055
C-5	Mica .0001 μfd	266017
C-6	Mica .00025 μfd	266258
C-7	Paper .05 μfd-400V	245055
C-8	Paper .1 μfd-200V	243014
C-9	Paper .005 μfd-600V	247056
C-10	Paper .1 μfd-200V	243014
C-11	Paper .02 μfd-400V	245025
C-12	Electrolytic 30-30-20 μfd/150-150-25V	213301

INDUCTORS

L-1	Broadcast coil	111204
L-2	Choke 5.5 hy	140003

RESISTORS

R-1	REGENERATION control 10KΩ (Includes S-1)	390002
R-2	1 megΩ, ½ W	301105
R-3	270KΩ, ½ W	301274
R-4	200Ω, 10 W	374001
R-5	82KΩ, ½ W	301823
R-6	470KΩ, ½ W	300474
R-7	150Ω, ½ W	301151

SWITCH

S-1	OFF (Attached to R-1)	(See R-1)

TRANSFORMER

T-1	Output	102200

TERMINAL STRIPS

Symbol No.	Description	Part No.
TS-1	3-terminal	440301
TS-2	2-screw terminal	441201
TS-3	2-terminal	502227

TUBES

V-1	12AT6	611014
V-2	50C5	610026
V-3	35W4	610029

MISCELLANEOUS

Description	Quantity	Part No.
Cabinet	1	702006
Chassis	1	461314
Clip, fahnestock	1	533003
Grommet, ⅜"	2	830200
Knob, control	2	762201
Knob, BAND SET	1	764503
List, SW stations	1	750098
Manual, instruction	1	750032A
Panel, front	1	462211
Socket, 7-pin	3	501070
Socket, 5-pin	1	501050
Spacer, ceramic	2	940004

HARDWARE

Lockwasher, ⅜"	1	582700
Lug, #8 solder	3	553002
Nut, hex 6-32 x ¼"	16	570340
Nut, hex ⅜"	1	570840
Screw, self tapping #4x¼"	2	562292
Screw, 6-32 x ⅛"	19	560343
Screw, 6-32 x ¼"	4	560342
Washer, fiber shoulder	1	591300
Washer, fiber flat	1	590301

WIRE, SOLDER, AND SPAGHETTI

Description	Quantity	Part No.
Cord, line	1	802001
Spaghetti, 1"	1	812001
Wire, 2" red	3	801002
Wire, 3" orange	4	801003
Wire, 4" yellow	3	801004
Wire, 6" blue	2	801006
Wire, 7" violet	2	801007
Wire, 1" bare	1	806007
Solder, 24" ROSIN CORE	1	930002

ACCESSORIES YOU MAY WANT

Stock No.	Description	*Price
59Y110	Headphones, 2000Ω	$2.00
83Y100	Antenna kit	1.03
81D616	Speaker, 4"	1.40
95D436	Cabinet, speaker	2.74
83Y741	Coil, long wave 155-470Kc	.79
83Y742	Coil, short wave 1.65-4.1Mc	.65
83Y743	Coil, short wave 2.9 7.3Mc	.65
83Y745	Coil, short wave 7-16.5Mc	.65
83Y744	Coil, short wave 15.5-35Mc	.65

TOOLS NEEDED FOR CONSTRUCTION

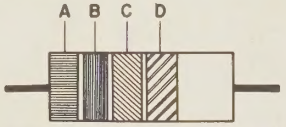
46N852	Soldering pencil	$5.26
50N132	6" long nose pliers	1.54
45N796	6" screwdriver	.72
50N133	5" diagonal cutting pliers	$1.34

* Subject to change.

CAPACITOR AND RESISTOR COLOR CODE

RESISTOR-MICA CAPACITOR COLOR CODE				
Color	Significant Figures	Multiplier	Tolerance %	Voltage Rating*
Black	0	1	±20*	—
Brown	1	10	±1*	100
Red	2	100	±2*	200
Orange	3	1,000	±3*	300
Yellow	4	10,000	±4*	400
Green	5	100,000	±5*	500
Blue	6	1,000,000	±6*	600
Violet	7	10,000,000	±7*	700
Gray	8	100,000,000	±8*	800
White	9	—	±9*	900
Gold	—	.1	±5	1,000
Silver	—	.01	±10	2,000
None	—	—	±20	500

*Applies to capacitors only

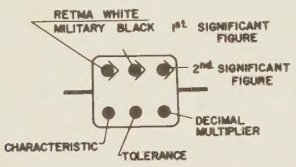


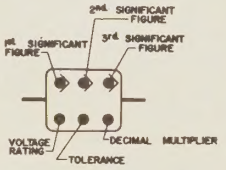
HOW TO DETERMINE THE VALUE OF A RESISTOR

A — First significant figure (digit) of resistance in ohms.
B — Second significant figure.
C — Decimal multiplier (number of zeros to be added).
D — Tolerance of resistor in percent. No color is 20%.

EXAMPLE:

A resistor has the following color bands: A, yellow; B, violet; C, yellow; and D, silver. The significant figures are 4 and 7 (47) and the multiplier is 10,000. The value of resistance is 470,000 ohms and the tolerance is ±10%.



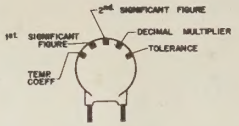


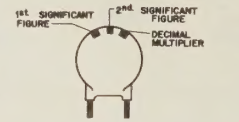
HOW TO DETERMINE THE VALUE OF A MICA CAPACITOR

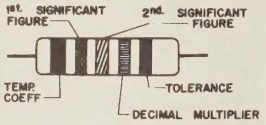
EXAMPLES:

A capacitor with a 6 dot code (new RETMA standard REC-115A and military MIL-C-5A) has the following markings: Top row, left to right, white, green, brown; bottom row, right to left, brown, red, red. The first color white indicates mica. The significant figures are 5 and 1 (51), and the decimal multiplier is 10. So the capacitance is 510 $\mu\mu$f. Tolerance is ±2%. For most general applications the characteristic can be ignored.

A capacitor with a 6 dot code has the following markings: Top row, left to right, brown, orange, red; bottom row, right to left, brown, red, green. Since the first dot is neither black or white, this is the obsolete RETMA code. The significant figures are 1, 3, and 2 (132), and the decimal multiplier is 10. So the capacitance is 1320 $\mu\mu$f. Tolerance is ±2%. Voltage rating is 500 V DC.







CERAMIC CAPACITOR COLOR CODE					
			Tolerance		
Color	Significant Figures	Decimal Figures	10 $\mu\mu$f or less ($\mu\mu$f)	Over 10 $\mu\mu$f (%)	Temp. Coef. (Parts per million per °C.)
Black	0	1	±2.0	±20	0
Brown	1	10	±0.1	±1	−33
Red	2	100	—	±2	−75
Orange	3	1,000	—	±2.5	−150
Yellow	4	10,000	—	—	−220
Green	5	—	±0.5	±5	−330
Blue	6	—	—	—	−470
Violet	7	—	—	—	−750
Gray	8	0.01	±0.25	—	+150 to −1500
White	9	0.1	±1.0	±10	+100 to −750
Gold	—	—	—	—	—

HOW TO DETERMINE THE VALUE OF A CERAMIC CAPACITOR

EXAMPLES:

A ceramic tubular capacitor has the following color bands: Black, red, red, red, green. The significant figures are 2 and 2 (22), and the decimal multiplier is 100. The capacitance is, therefore, 2200 $\mu\mu$f. Tolerance is ±5%. Temperature coefficient is 0. Voltage rating is always 500 V.

A ceramic disc capacitor has the following 5-dot code: Red, brown, green, red, green. The significant figures are 1 and 5 (15), and the decimal multiplier is 100. The capacitance is, therefore, 1500 $\mu\mu$f. The tolerance is ±5%. The temperature coefficients — 75. Voltage rating is always 500 V.

A ceramic disc capacitor has the following 3-dot code: Green, brown, brown. The significant figures are 5 and 1 (51), and the decimal multiplier is 10. Therefore, the capacity is 510 $\mu\mu$f. Voltage rating is always 500 V and the tolerance is always — 0.

TUBULAR PAPER CAPACITOR COLOR CODE				
Color	Significant Figures	Decimal Multiplier	Tolerance %	Voltage Rating (v d-c)
Black	0	1	±20	—
Brown	1	10	—	100
Red	2	100	—	200
Orange	3	1,000	±30	300
Yellow	4	10,000	—	400
Green	5	—	—	500
Blue	6	—	—	600
Violet	7	—	—	700
Gray	8	—	—	800
White	9	—	—	900
Gold	—	—	—	1,000
Silver	—	—	±10	—

HOW TO DETERMINE THE VALUE OF A PAPER TUBULAR CAPACITOR

A — First significant figure (digit) of capacitance in $\mu\mu$f.

B — Second significant figure.

C — Decimal multiplier (number of zeroes to be added).

D — Tolerance of capacitor in percent.

E — Voltage rating.

EXAMPLE:

A paper tubular capacitor has the following color bands: A, brown; B, green; C, orange; D, black; and E, yellow. The significant figures are 1 and 5 (15) and the decimal multiplier is 1,000. The value of capacitance is 15,000 $\mu\mu$f. The tolerance is ±20%. The voltage rating is 400 V DC.

KNIGHT-KITS ARE YOUR BEST BUY THE FINEST ELECTRONIC EQUIPMENT IN KIT FORM. CREATIVE ENGINEERING AND USE OF PREMIUM QUALITY PARTS ASSURE SUPERIOR PERFORMANCE. THAT'S WHY KNIGHT-KITS ARE SOLD WITH THIS EXCLUSIVE GUARANTEE: *EVERY KNIGHT-KIT MUST MEET PUBLISHED SPECIFICATIONS OR WE REFUND YOUR MONEY.*

KNIGHT-KITS ARE "CONVENIENCE ENGINEERED" RESISTORS ARE CARD MOUNTED AND IDENTIFIED. WIRE IS PRECUT. SMALL PARTS ARE PACKAGED IN SEE-THROUGH PLASTIC BAGS. DETAILS SUCH AS THESE AND STEP-BY-STEP INSTRUCTION MANUALS MAKE KNIGHT-KITS EASIEST TO BUILD.

KNIGHT-KITS ARE THE FIRST CHOICE OF EXACTING BUILDERS OF ELECTRONIC KITS EVERYWHERE AND HAVE BEEN SINCE THE EARLY 20's. THERE IS AN OUTSTANDING KNIGHT-KIT AVAILABLE FOR EVERY REQUIREMENT. EACH IS A REWARDING ADVENTURE IN KIT CONSTRUCTION. YOU WILL BE PROUD TO BUILD AND OWN A KNIGHT-KIT.

38K161-750032-15-AP-860